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[Claim(s)]
[Claim 1] Ultrasonic diagnostic equipment characterized by providing a reflective detection means to detect a reflection of the ultrasonic wave by an acoustic lens, and a wave transmission control means to control wave transmission of an ultrasonic probe according to the output of the reflective detection means, in ultrasonic diagnostic equipment equipped with the ultrasonic probe which has an acoustic lens.

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to ultrasonic diagnostic equipment equipped with the ultrasonic probe which has an acoustic lens about ultrasonic diagnostic equipment.
[0002]
[Description of the Prior Art] If an ultrasonic probe is neglected in the air for a long time, since the vibrational energy of a piezo-electric element is not released, an ultrasonic probe will generate heat, and the characteristic will be degraded.
[0003] In order to prevent this, the ultrasonic diagnostic equipment of the indication is proposed by JP,S63-122429,A, for example. In the ultrasonic diagnostic equipment of the indication to this JP,S63-122429,A [the signal waveform a received when an ultrasonic probe is applied to a living body, as shown in drawing 7] [the signal waveform b received when the sample period g1 or the sample period g2 also neglects an ultrasonic probe in the air to a thing with a large signal level] It is judged whether paying attention to the point that the signal level in the sample period g2 becomes remarkably small, it is neglected by the ultrasonic probe in the air from the signal level in the sample period g1. And when it judges with being neglected by the ultrasonic probe in the air, the drive of an ultrasonic probe is interrupted.
[0004]
[Problem to be solved by the invention] In the above-mentioned conventional ultrasonic diagnostic equipment, it is judged whether it is neglected by the ultrasonic probe in the air paying attention to the sample period g1 and the signal level in g2. However, even when having applied the ultrasonic probe to the living body, the portion corresponding to the sample period g1 [with a body tissue] Supposing the portion corresponding to the sample period g2 is water in the inside of a living body, the signal waveform received will become like the signal waveform d of drawing 8 , and will be judged accidentally [neglect / by the ultrasonic probe / in the air]. That is, it is neglected by the ultrasonic probe in the air, or there is a problem which is not sure. [of no]
[0005] Then, an ultrasonic probe judges correctly whether it is neglected in the air, and the purpose of this invention has it in offering the ultrasonic diagnostic equipment which controls wave transmission of an ultrasonic probe.
[0006]
[Means for solving problem] In the ultrasonic diagnostic equipment with which the ultrasonic diagnostic equipment of this invention was equipped with the ultrasonic probe which has an acoustic lens It is characterized [constitutional] by providing a reflective

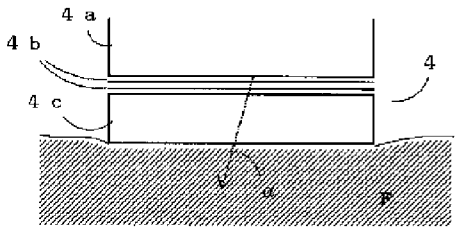
detection means to detect a reflection of the ultrasonic wave by an acoustic lens, and a wave transmission control means to control wave transmission of an ultrasonic probe according to the output of the reflective detection means.
[0007]
[Function] When having applied the ultrasonic probe which has acoustic lenses, such as rubber, to the living body, an ultrasonic wave does not produce the multiple reflection of an ultrasonic wave in an acoustic lens, but advances in the living body. However, if it is neglected in the air, the multiple reflection of an ultrasonic wave will be produced in an acoustic lens. So, in the ultrasonic diagnostic equipment of this invention, it is judged whether a reflective detection means detects a reflection of the ultrasonic wave by an acoustic lens, and it is neglected by the ultrasonic probe in the air. And when it judges with being neglected by the ultrasonic probe in the air, wave transmission of an ultrasonic probe is interrupted or controlled by a wave transmission control means.
[0008] Thus, since its attention is paid to a reflection of the ultrasonic wave in an acoustic lens, it can be judged correctly whether it is neglected by the ultrasonic probe in the air.
[0009]
[Working example] Based on the work example shown in a figure, this invention is explained still in detail hereafter. In addition, thereby, this invention is not limited. Drawing 1 is the important section block diagram of the ultrasonic diagnostic equipment of one work example of this invention.
[0010] In this ultrasonic diagnostic equipment 1, the transmitting beamformer 3 transmits an ultrasonic wave from the ultrasonic probe 4 synchronizing with the system trigger which the system trigger generating part 2 generates. It is received by the ultrasonic probe 4 and an ultrasonic echo signal is inputted into DSC7 through the receiving beamformer 5 and the filter logarithm compression part 6. And a picture is generated by DSC7 and it is displayed on CRT8.
[0011] The waveform-shaping part 10 is a filter circuit which removes ringing and a noise and extracts only a portion with a high signal level from the output signal of said filter logarithm compression part 6. Only a predetermined period outputs the gating signal of "H" from the system trigger signal with which said system trigger generating part 2 generates the gating signal generating part 11. Moreover, said predetermined time can be adjusted so that the multiple reflection of the ultrasonic wave by an acoustic lens can be detected. The pulse generating part 12 will output a pulse, if the output signal of said waveform-shaping part 10 becomes higher than a predetermined level when said gating signal is "H".
[0012] If the pulse interval judging part 13 measures the interval of said pulse and continues three or more pulses at equal intervals, it will judge with being neglected by the ultrasonic probe 4 in the air, and will output a wave transmission control signal to said transmitting beamformer 3. On the other hand, if three or more pulses continue by non-regular intervals, the ultrasonic probe 4 will judge with having been guessed by the living body, and will suspend the output of the wave transmission control signal to said transmitting beamformer 3.
[0013] [the beamformer / the transmitting beamformer 3 is transmitting the ultrasonic wave from the ultrasonic probe 4 like point ** synchronizing with a system trigger, while the wave transmission control signal is not inputted, but] While the wave transmission control signal is inputted, synchronizing with 100 times of a system trigger only in 1

time, the ultrasonic wave was transmitted from the ultrasonic probe 4, and 99 next times are stopped. In addition, 1 time per frame is sufficient.
[0014] The above-mentioned ultrasonic probe 4, the receiving beamformer 5, the filter logarithm compression part 6, the waveform-shaping part 10, the gating signal generating part 11, the pulse generating part 12, and the pulse interval judging part 13 constitute a reflective detection means. Moreover, the above-mentioned transmitting beamformer 3 constitutes a wave transmission control means.
[0015] Now, drawing 2 expresses the state where the ultrasonic probe 4 was applied to the living body. As alpha shows to drawing 2 , it acts as Idei of the ultrasonic wave from the piezo-electric ceramics 4a, it penetrates the matching film 4b and the rubber lens 4c, and is advancing in a living body F. At this time, the **** signal A shown in drawing 3 is inputted into the waveform-shaping part 10, and the **** signal B shown in drawing 3 is outputted from the waveform-shaping part 10. The pulse generating part 12 will output the pulse of the **** signal D shown in drawing 3 , if the **** signal B shown in drawing 3 becomes larger than the predetermined level T when **** gating signal C shown in drawing 3 is "H". If the signal D of drawing 3 is inputted, since the pulse interval P1 and P2 are not equal as for the pulse interval judging part 13, it will not output a wave transmission control signal. Then, the transmitting beamformer 3 transmits an ultrasonic wave from the ultrasonic probe 4 synchronizing with a system trigger.
[0016] Next, drawing 4 expresses the state where the ultrasonic probe 4 was neglected in the air. As shown to drawing 4 in alpha 1 and alpha 2, multiple reflection of the ultrasonic wave is carried out with the rubber lens 4c. At this time, the **** signal A shown in drawing 5 is inputted into the waveform-shaping part 10, and the **** signal B shown in drawing 5 is outputted from the waveform-shaping part 10. The pulse generating part 12 will output the pulse of the **** signal D shown in drawing 5 , if the **** signal B shown in drawing 5 becomes larger than the predetermined level T when **** gating signal C shown in drawing 5 is "H". If the signal D of drawing 5 is inputted, since the pulse interval P1, P2, and P3 are equal as for the pulse interval judging part 13, it will output a wave transmission control signal. Then, the transmitting beamformer 3 transmitted the ultrasonic wave from the ultrasonic probe 4 synchronizing with 100 times of a system trigger only in 1 time, and 99 next times have stopped it. For this reason, generation of heat of the ultrasonic probe 4 is controlled. An ultrasonic wave is transmitted only once from the ultrasonic probe 4 to 100 times of a system trigger in order to detect what the ultrasonic probe 4 was again applied for by the living body, to suspend the output of a wave transmission control signal and to return to the usual state automatically.
[0017] In addition, a level T is set as the level which is a grade, for example exceeding the signal based on the 4th multiple reflection.
[0018] As other work examples, that to which the transmitting beamformer 3 reduces wave transmission power with a wave transmission control signal is mentioned.
[0019] Furthermore, as shown in drawing 6 , as other work examples [the period of "H" of gating signal C] It is short set as the grade which receives the signal based on the 1st and/or the 2nd multiple reflection, and when the signal B inputted during the period exceeds the predetermined level T, what a pulse interval judging part detects as multiple reflection by an acoustic lens is mentioned.
[0020]

[Effect of the Invention] According to the ultrasonic diagnostic equipment of this invention, an ultrasonic probe can detect correctly the state where it was neglected in the air. Moreover, since this controls the wave transmission from an ultrasonic probe, generation of heat and characteristic degradation can be prevented certainly.

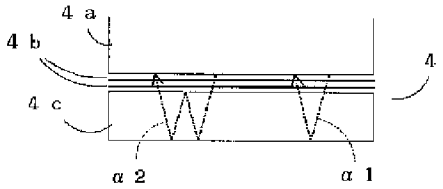
[Brief Description of the Drawings]
[Drawing 1] It is the important section block diagram of one work example of the ultrasonic diagnostic equipment of this invention.
[Drawing 2] It is an explanatory view in the state where the ultrasonic probe was applied to the living body.
[Drawing 3] It is the wave form chart of the signal of each part of the equipment of drawing 1 .
[Drawing 4] It is an explanatory view in the state where the ultrasonic probe was neglected in the air.
[Drawing 5] It is the wave form chart of the signal of each part of the equipment of drawing 1 .
[Drawing 6] It is the wave form chart of the signal concerning the work example of further others of the ultrasonic diagnostic equipment of this invention.
[Drawing 7] In conventional ultrasonic diagnostic equipment, an ultrasonic probe is the explanatory view of the principle which judges the state where it was neglected in the air.
[Drawing 8] It is the wave form chart of the signal concerning conventional ultrasonic diagnostic equipment.
[Explanations of letters or numerals]
1 Ultrasonic Diagnostic Equipment
3 Ultrasonic Beamformer
4 Ultrasonic Probe
4c Rubber lens
10 Waveform-Shaping Part
11 Gating Signal Generating Part
12 Pulse Generating Part
13 Pulse Interval Judging Part

[Drawing 2]
(図２)

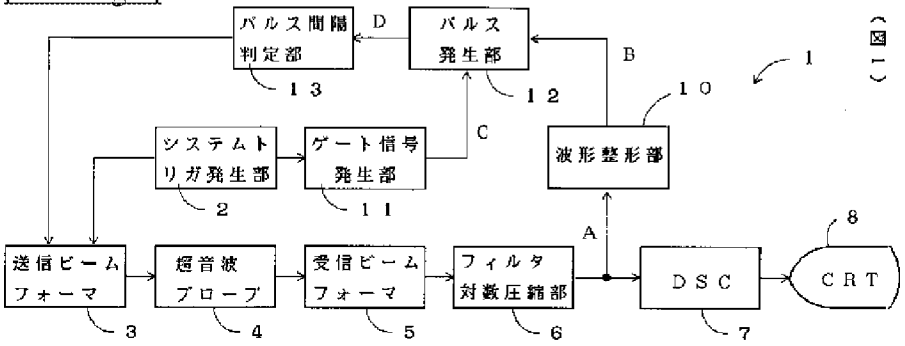


[Drawing 4]

（図４）

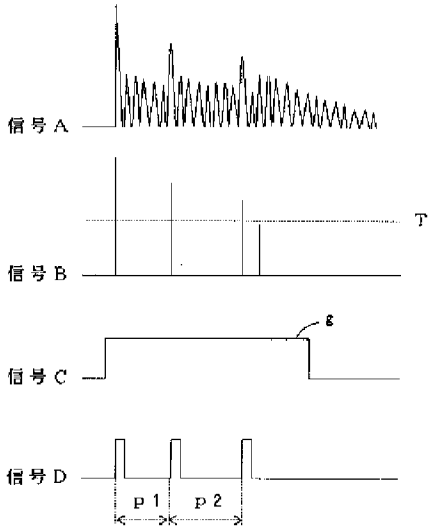


[Drawing 1]



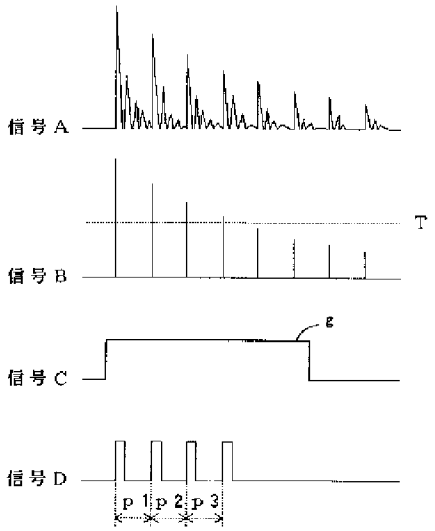
[Drawing 3]

（図３）



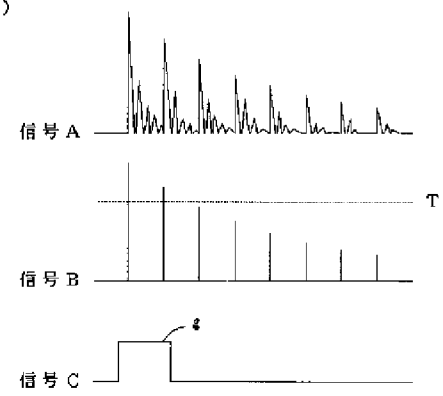
[Drawing 5]

（図５）



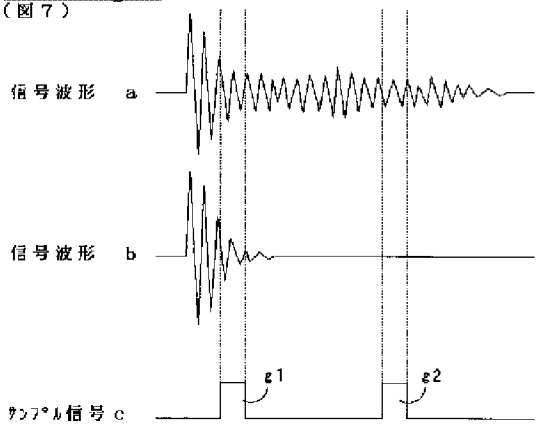
[Drawing 6]

（図６）



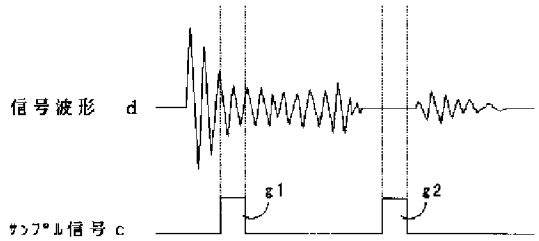
[Drawing 7]

（図７）



[Drawing 8]

（図８）



[Translation done.]